

28. (New) The method of claim 24, wherein said laser resonator also comprises a non-linear crystal, and wherein said at least one discontinuous phase element is selected and disposed such that the intensity of said resonator mode in said non-linear crystal is generally higher than its intensity in said gain medium.—

REMARKS

Claims 1-28 are pending in this application. Claims 1, 7, and 13-15 are amended, and new claims 16-28 are added. Applicants respectfully request that the Examiner initialize and return the IDS filed May 31, 2000.

The drawings stand objected to under 37 CFR § 1.83(a) because the "discontinuous external phase element" specified in claim 15 is not shown in the drawings. Applicants have amended Fig. 17 to show the discontinuous external phase element. Applicants have also amended the specification at the location where this feature is referred to, by addition of the reference character of this feature. No new matter is added. A letter to the draftsman in accordance with MPEP § 608.02(r) is enclosed. Copies of the amended drawings, showing the changes in red ink are also enclosed in accordance with MPEP § 608.02(v). Consequently, it is respectfully requested that the above objection be withdrawn.

Claim 15 was objected to because of the use of the term "may be." Applicants believe that the Examiner has objected to claim 13, and not to claim 15 as stated, because the term "may be" is only used in claim 13. Applicants have amended claim 13 to delete the term "may be", thereby removing the uncertainty of

the limitation. Therefore, it is respectfully requested that the above objection be withdrawn.

Claims 1-15 are rejected under 35 USC § 112, second paragraph, as being indefinite for failing to point out and distinctly claim the subject matter which the applicants regard as the invention. The Examiner has stated that it is unclear in the claim language what is meant by "discontinuous phase element".

Applicants have amended claim 1 to recite that the discontinuous phase element has "at least one sharp discontinuity adapted to introduce a discontinuous phase change in at least one mode propagating in said resonator", thus providing a structural feature of the discontinuous phase element, and a description of the effect of that structural feature in the resonator.

Claim 15 is rejected under 35 U.S.C § 112, second paragraph, as being indefinite for failing to point out and distinctly claim the subject matter which the applicants regard as the invention. The Examiner has stated that it is unclear in the claim language the reference made to "internal element".

Applicants have amended claim 15 to recite the "at least one discontinuous phase element disposed between said reflector elements" instead of the internal element. Accordingly, it is respectfully requested that the above rejections be withdrawn.

Claims 1-5, 7-12, 14 and 15 stand rejected under 35 USC § 102(b) as being anticipated by Fink (U.S. patent No. 5,283,796). Claim 6 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Komine (U.S. patent No. 5,400,173). Claim 13 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Fink (U.S. patent No. 5,283,796) in view of Casperson (Laser Focus World, May 1994). In view of the foregoing

amendments to the claims, Applicants submit that all of the pending claims in the application are patentable over the cited references, and reconsideration and allowance of this application are respectfully requested.

Amended claim 1 of the present invention now recites:

"An optical resonator comprising reflector elements and at least one static discontinuous phase element disposed between said reflector elements, said at least one static discontinuous phase element having at least one sharp discontinuity adapted to introduce a discontinuous phase change in at least one mode propagating in said resonator." (emphasis added)

Similarly, new independent claim 20 recites:

"A method of improving the output beam quality of a laser, comprising:

providing a laser resonator having reflector elements and a gain medium; and

disposing at least one static discontinuous phase element between said reflector elements, said at least one static discontinuous phase element having at least one sharp discontinuity adapted to introduce a discontinuous phase change in at least one mode propagating in said laser resonator."

The Examiner states that in figure 10, Fink illustrates a laser system having two reflectors (111,113) forming a resonator where mirror 111 is an output mirror, a gain medium (51) placed between the mirrors and a phase plate (27) between the mirrors for tuning the modes of the resonator.

However, Fink does not disclose the static discontinuous phase element of the present Application. In Fink, the phase

element is operative to change the effective optical length of the laser cavity, so that its longitudinal mode, and hence the lasing frequency changes. The Fink invention is enabled by rotating the phase element, if it is a helical wheel, or by oscillating it if it is wedge shaped, in order to provide a frequency modulation chirp to the laser output. Thus, Fink describes a phase element that is rotated or oscillated.

Unlike the Fink invention, the discontinuous phase element of the Claims 1 and 20 is static within the reflector elements, and the lasing frequency is therefore fixed. Thus, the phase element of the claimed invention does not rotate, nor does it oscillate. In the instant claimed invention, the discontinuous phase element within the reflector elements affects the angular (or radial) distribution of the modes propagating within the reflector elements, thereby generally eliminating undesirable modes, promoting desirable modes and thereby selectively improving the quality of the laser output beam. This is effected by changing the angular (or radial) phase distribution of the modes each time they traverse the discontinuous phase element.

In short, the independent claims 1, and 20 define a novel and unobvious invention over the cited references. The dependent claims 2-19, and 21-28 are all dependent, either directly or indirectly, from the independent claims, and therefore, include all the limitations of the claims from which they depend. Accordingly, these claims are also allowable for the same reason set forth above as well as the additional limitations recited.

In view of the foregoing amendments and remarks, it is respectfully submitted that this application is now in condition

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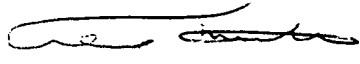
for allowance, and accordingly, reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The

attached page is captioned "Version with markings to show changes made."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) An optical resonator comprising reflector elements and at least one static discontinuous phase element disposed between said reflector elements, said at least one static discontinuous phase element having at least one sharp discontinuity adapted to introduce a discontinuous phase change in at least one mode propagating in said resonator.

7. (Amended) An optical resonator according to claim 1, and being a stable resonator.

13. (Amended) An optical resonator according to claim 1, and wherein said at least one discontinuous phase element is positioned adjacent to a flat output coupler of said optical resonator, and the full reflector of said resonator [may be] is curved.

14. (Amended) An optical resonator according to claim 1, and wherein said at least one discontinuous phase element also provides [discontinuous phase change as well as] at least one of angular, linear and radial phase change.

15. (Amended) An optical resonator according to claim 1, and also comprising an external discontinuous phase element having at least one sharp discontinuity, operative in addition to [the internal element] said at least one discontinuous phase element disposed between said reflector elements, in order to improve [cancel distortions and eliminate phase discontinuities in] an output beam from said optical resonator.